

# For a field-proven 100-Megawatt Laser



**New TRG 104A meets requirements  
both in the lab and "on the line".**

For the industrial laser technologist and the scientific researcher, the new TRG 104A is a rugged, reliable, versatile and economical laser system. It is already functioning under a wide range of operating conditions for such applications as: atmospheric studies, ballistic research, chemical research, high-speed photography, medical and biological research, optical ranging, vacuum evaporation of thin films, microwelding, optical machining. Special features include: Maintenance-free operation in excess of 25,000 cycles. Flashlamp replacement without realignment of optics. Simple function switch for rapid selection of either normal pulse or Q-switched operation. Optical alignment maintained under normal operating conditions of shock and vibration. For more complete information write: TRG Inc., Section LF, Route 110, Melville (Long Island), New York 11746 Tel. (516) 531-6343.

## Accessories

- 104A-4 — Second Harmonic Generator
- 104A-5 — Liquid Q-switch
- 104A-6 — Single Pulse Accessory
- 104A-7 — Base Plate
- 104A-8 — Base Plate for 104A Laser and 109A Accessory

## Specifications

### Output

- Normal Mode.....3 to 5 joules
- Q-switched Mode...1 to 1.5 joules
- Wavelength .....6943Å or 10600Å
- Minimum Recycle Time 15 seconds
- Power .....100 Megawatts plus



*TRG/A Subsidiary of  
Control Data Corporation*

ELECTRO-OPTICAL PRODUCTS

October 1966

ENERGY AND POWER MEASURING DEVICES

<u>MODEL NUMBER</u>	<u>DESCRIPTION</u>	<u>PRICE</u>
100	Ballistic Thermopile (1cm aperture).....	\$ 385.00
101	Ballistic Thermopile (1cm aperture).....	525.00
	Permits an oscilloscope observation of laser output pulses in addition to measuring energy output	
102	Energy Meter for use with 100/101.....	585.00
107	Ballistic Thermopile (2cm aperture).....	550.00
108	Ballistic Thermopile (2cm aperture).....	690.00
113	Energy Meter for use with 107/108.....	585.00
105B	Photodetector.....	
	With S-4 Surface.....	1500.00
	With S-1 or S-20 Surface.....	1850.00
	With S-1 UV Surface.....	1850.00

LASER SYSTEMS

103A	Minilaser - 300 Millijoules.....	
	Consists of: 103A-1 Laser Power Supply.....	1000.00
	103A-2 Laser Head.....	1000.00
104A	Laser System and Accessories.....	
	104A-1 Laser Power Supply.....	2950.00
	104A-2 Laser Head.....	
	Supplied with Czochralski ruby.....	2090.00
	Supplied with Nd+++ rod.....	1950.00
	104A-3 Rotating Prism Q-switch.....	2200.00
	104A-4 Second Harmonic Generator.....	950.00
	Specify wavelength, 6943Å or 10600Å, at which SHG will be used	
	104A-5 Bleachable Q-switch.....	750.00
	104A-6 Bleachable Single Pulse Accessory.....	500.00
	This accessory is included as part of the Model 104A-100 Megawatt Laser System. If this Model 104A-6 Single Pulse Accessory is purchased as an individual component or for addition to an existing Model 104A Laser System, the buyer should be aware that damage to the laser crystal may occur due to the higher achievable power densities. Check with TRG Sales (516/531-6343) regarding questions on how to utilize this accessory in the buyer's system. Specify wavelength at which accessory is to be used (6943Å or 10600Å).	
	104A-7 Base Plate to aid precise aiming of laser head.....	250.00
	Standard Czochralski ruby rod with lucalox holders.....	690.00
	Standard Czochralski ruby rod, without holders, ground for 104A-2 Laser Head.....	615.00
	Nd+++ doped glass laser rod including UV filter and holder.....	375.00
	Nd+++ doped glass rod, without filter and holder, ground for 104A-2 Laser Head.....	350.00

Dielectric coated output reflector (Specify 6943A or 10600A).....	100.00
Cavity reflector for 104A-2 Laser Head.....	90.00
Resonant reflector for 104A-2 Laser Head.....	200.00
Replacement flash lamps for 104A-2 Laser Head....	64.50

Model 104A Laser System capable of 100 megawatt output.....	8600.00
Model 104A Laser System capable of 100 megawatt output with beam divergence of less than 3 milliradians.....	9600.00
Model 200B Laser System capable of 100 megawatt output at 15 pps..	19950.00

Model 300 Series

Model 301 Laser System capable of 250 megawatt output.....	19950.00
Model 302 Laser System capable of 600 megawatt output.....	24950.00
Model 303 Laser System capable of 1000 megawatt output.....	29950.00

LASER ACCESSORIES

109A	Daly-Sims Accessory.....	1500.00
104A-8	Base Plate - to facilitate mounting and alignment of the 104A Laser System with the 109 Daly-Sims Accessory independent of an optical bench.....	495.00

LASER SAFETY EYESHIELDS

112	Laser Safety Eyeshields.....	50.00
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BIOLOGICAL LASER SYSTEM

513	Biolaser System.....	
	Designed specifically for Leitz microscopes but adapters are available for other microscopes. Contact TRG Sales regarding customers' require- ments.	
	Consists of:	
	103A Minilaser.....	2000.00
	153A Coupling with 513-4 Safety Interlock.....	1200.00
	Accessories:	
	153A-5 Camera Adapter including Optics and Dichroic Filter (Specify camera to be used)	250.00
	513-5 Substage Energy Monitor.....	325.00
	102 Energy Meter.....	585.00

- NOTE: (1) All delivery quotations are subject to prior sale.  
 (2) Prices and specifications are subject to change without notice.  
 (3) This price list is in effect until May 1967.

*designers and  
manufacturers  
of precision  
scientific optical  
and measuring  
instruments*

GAERTNER SCIENTIFIC CORPORATION / 1201 WRIGHTWOOD AVE., CHICAGO, ILL. 60614 / 312 BU 1-5335 / CABLE: SCIENTIA



December 21, 1966

Nelsons Systems  
Box 1546  
Poughkeepsie, N.Y.

Gentlemen:

Thank you for your inquiry requesting information on our products.

Enclosed is the General Index to the literature that we currently have available. Please indicate the bulletins you desire on the Business reply card and return it to us. The information will be forwarded promptly.

We will look forward to being of service.

Our local representative in your area is Clarkson & Foreman, Inc. 664 E. 6th St., P.O. Box 1446, Plainfield, New Jersey. Their telephone number is 753-4887.

Very truly yours,

Lyman W. Higgins,  
Director of Marketing

LWH:ar  
Enc:Index-Card





LASER PRODUCTS

FOR SCIENCE,  
INDUSTRY, DEFENSE



CONTROL DATA  
CORPORATION

## LASER SYSTEMS, MEASURING DEVICES, AND ACCESSORIES

TRG, A DIVISION OF CONTROL DATA CORPORATION  
ROUTE 110, MELVILLE, NEW YORK (516) 531-6343

### Model 104A LASER SYSTEM...



TRG's new 104A Laser System has been designed specifically to meet the needs of the scientific researcher and the industrial laser technologist. A medium-power, economical laser system that is capable of operation under a wide range of conditions — including adaptability to those outside a laboratory environ-

ment — the TRG 104A can be used for many applications, such as: Atmospheric Studies; Ballistic Research; Chemical Research; High-speed Photography; Medical and Biological Research; Optical Ranging; Vacuum Evaporation of Thin Films; Microwelding.

#### accessories

- 104A-4 — Second Harmonic Generator
- 104A-5 — Liquid Q-switch
- 104A-6 — Single Pulse Accessory
- 104A-7 — Base Plate
- 104A-8 — Base Plate for 104A Laser and 109A Accessory

#### specifications

Normal Mode Output .....	3 to 5 joules
Q-switched Mode Output .....	1 to 1.5 joules
Peak Power Output Available .....	100 megawatts plus
Wavelength .....	6943Å or 1.06μ
Minimum Recycle Time .....	15 seconds

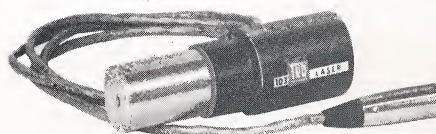
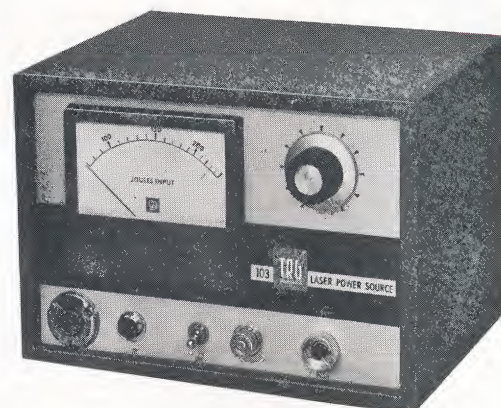


## Model 103A MINILASER SYSTEM...

The TRG Model 103A Minilaser System is a versatile, lightweight laser that produces repeatable outputs of controlled energy. Designed primarily for the student or researcher whose requirements involve the techniques of laser technology. This system can easily be adapted for use in solving optical, biological, and many other laboratory and industrial problems.

### specifications

Wavelength .....	6943 Å or 1.06 $\mu$
Pulse Length .....	150 $\mu$ sec.
Repetition Rate	
Uncooled .....	1 per minute
Cooled .....	1 pulse every 30 seconds
Energy Input .....	230 joules (max.)
Energy Output .....	0-300 millijoules (nominal)
Threshold .....	150 joules (nominal)
Effective Beam Diameter .....	5 mm
Beam Divergence .....	10 milliradians (nominal)
Coating .....	Multilayer dielectric
Input Voltage .....	115/220 volts AC $\pm$ 10%
Trigger .....	Remote or panel push button
Interconnecting Cables .....	a. Line cord supplied b. 6 foot cable connectors supplied to connect 103A Laser Head to power supply



## Model 200B LASER SYSTEM...

The 200 Laser is a medium-powered system with outputs up to 15 pulses per second. The system can be operated in the normal or Q-switched mode and closed cycle water cooling systems are available.

### specifications

Output Wavelength .....	6943Å or 1.06 $\mu$
Maximum Pulse Energy	
Normal Mode .....	3-5 joules
Q-switched Mode .....	0.5 joule
Peak Power Output Available .....	100 megawatts
Repetition Rate .....	Variable 1-15 pps
Type of Q-switch .....	Rotating prism with bleachable dye (other Q-switches available on request)
Beam Divergence .....	3-5 milliradians



## Series 300 LASER SYSTEMS...

The 300 Laser System series designates a line of high powered high energy lasers with output powers up to one gigawatt and repetition rates from 2 cycles per minute for laboratory use to 5 cycles per second for operational requirements.

### specifications

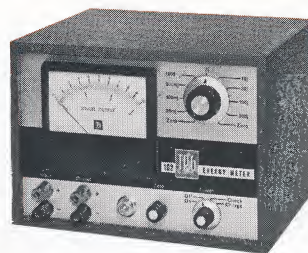
	MODEL 301	MODEL 302	MODEL 303
Output Wavelength	6943Å or 1.06 $\mu$	6943Å or 1.06 $\mu$	6943Å or 1.06 $\mu$
Maximum Energy in Joules	30	75	125
Peak Power Output Available	250 megawatts	600 megawatts	1 gigawatt
Pulse Repetition Rate	Available with repetition rates varying from 2 pulses per minute to 5 pulses per second to meet individual specifications.		
Pulse Length			
Normal	0.3 millisecond	0.6 millisecond	1 millisecond
Q-switched Mode	15 nanoseconds	15 nanoseconds	15 nanoseconds
Type of Q-switch	Rotating prism with bleachable dye (other Q-switches available on request)		
Beam Divergence	3-5 milliradians	3-5 milliradians	3-5 milliradians





## Models 102 & 113 ENERGY METERS...

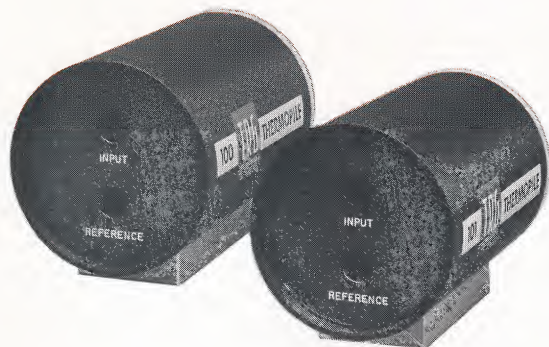
The TRG Model 102 and 113 Energy Meters are precision transistorized microvoltmeters designed specifically for use with Thermopiles having outputs of 35 to 300 microvolts per joule (such as the TRG Models 100, 101, 107 and 108 Ballistic Thermopiles). The meter is calibrated to read directly in joules.



### specifications

	MODEL 102	MODEL 113
Power	105 to 125 volts, or 208 to 220 VAC 50 to 400 Hz, 4½ watts	105 to 125 volts, or 208 to 220 VAC 50 to 400 Hz, 4½ watts
Ranges	9 overlapping ranges, 0.03 to 300 joules	9 overlapping ranges, 0.1 to 1000 joules
Zero Stability	±2 mj per day	±2 mj per day
Input	100 to 300 microvolts per joule	35 to 75 microvolts per joule
Accuracy	±2% of full scale ±10% change in input voltage results in less than 1 mj change in output.	±2% of full scale ±10% change in input voltage results in less than 2 mj change in output.
Zero Suppression	±60 mj by means of 10-turn front-panel control	±250 mj by means of 10-turn front-panel control
Calibration	Reads directly in joules, internally calibrated to the thermopile in use.	
Optional Accessory	Battery operation with internal nickel-cadmium battery, charger internal.	
Size	10½" x 7¼" x 8¾".	
Weight	13 pounds	
Shipping Weight	17 pounds	
Response Time	Less than 2.5 seconds on all scales	

## Models 100 & 101 BALLISTIC THERMOPILES...



### One-cm-diameter aperture types

**MODEL 100** — A high-sensitivity, precision instrument offering direct primary calorimetric measurement of laser outputs up to 300 joules over a dynamic range of  $3 \times 10^5$ .

**MODEL 101** — Photodiode version of Model 100. Permits simultaneous energy measurement and observation of optical pulse waveshapes.

## Models 107 & 108 BALLISTIC THERMOPILES...

### Two-cm-diameter aperture types

**MODEL 107** — A large aperture unit designed to meet the requirements of giant-pulse and large laser systems. Can handle energies up to 1000 joules (normal mode) and peak powers in the gigawatt range.

**MODEL 108** — Photodiode version of Model 107. Permits simultaneous energy measurement and observation of optical pulse waveshapes.

## Model 105B PHOTODETECTOR...



**MODEL 105B** — A detector containing a vacuum photodiode incorporated into a specially designed wide-band microwave structure. Each unit is individually calibrated to measure peak power of fast rising optical wave forms.

### specifications

Rise Time	less than 0.3 nanosecond
Bandwidth	DC to 1.25 GHz
Output Impedance	125 ohms
Output	75 volts into 125-ohm load
Bias Required	+2000 volts DC

Surface	S-1 (U.V.)	S-1	S-4	S-20
Spectral Response	2000-12000	3000-12000	3000-7000	3000-8500
Typical sensitivity	400-900	400-900	10-25	2000-5000
volts per megawatt at 6943Å across 125 ohms with diffusing disk (supplied)				

**MODEL 105-1** — Optical filter set for Model 105B Photodetector consists of four calibrated optical filters to attenuate laser pulse to prevent current saturation in the photodetector. Nominal transmission values: 1%, 6%, 25%, 50% at 6943Å.





### Model 109A DALY - SIMS ACCESSORY...

The Model 109A Daly-Sims Accessory is an optical device that uses the phenomenon of total internal reflection in a multiple-reflection optical plate to increase the switching speed of a rotating or oscillating prism Q-switch.

When used in conjunction with the TRG 104A Laser and Q-switch System, single-pulse operation in the 30-megawatt range is achieved. Although specifically designed for use with the Model 104A System, the 109A accessory can be used with any laser resonator that has a rotating or oscillating reflector.

### Model 112 LASER SAFETY EYESHIELD...

TRG Laser Safety Eyeshields provide eye protection in the low and medium energy pulse range and in the spectral range between 0.69 and 1.2 microns. They are designed for use by persons working with ruby and neodymium lasers. The special filter glass provides a reasonable assurance of safety to a radiance of  $10^9$  joules/cm<sup>2</sup>/steradian at 6943Å. This glass transmits sufficient ambient light to enable the wearer to work without difficulty, and the hue of the transmitted light is not psychologically disturbing. Clear plastic shield protects wearer in the event filter glass shatters.



### Model 513 BIOLASER SYSTEM...

The versatile new TRG Biolaser offers the medical and biological researcher a powerful new tool for use in studies at the cell level. Specific areas of application are: cell microsurgery and coagulation; electric field interaction; pathology; genetics; other branches of microscopic research.

Adapters are available to permit simultaneous photography and irradiation of the specimen. Cinemicrography, time-lapse photography, and closed-circuit television techniques can be applied to broaden the instrument's capabilities as a research tool.

**SPECIAL FEATURES** — The coherent light output of the Biolaser can be focused to spots as small as one micron — A simple x-y control permits precise spot positioning — Triggering can be remote or by panel pushbutton.

#### specifications

Flux Density on Stage	.....up to $10^4$ joules/cm <sup>2</sup>
Wavelength	.....*6943 Å
Pulse Length	.....150 μsec.
Repetition Rate	.....1/min.
Microscope	.....Leitz Ortholux or Labolux standard; adapters available for other microscopes
Camera	.....2¼" x 3¼" Polaroid standard; others optional

\*Other wavelengths on request.



*for detailed information call or write:  
TRG, or our local representative.*



ELECTRO-OPTICAL PRODUCTS

October 1966

ENERGY AND POWER MEASURING DEVICES

<u>MODEL NUMBER</u>	<u>DESCRIPTION</u>	<u>PRICE</u>
100	Ballistic Thermopile (1cm aperture).....	\$ 385.00
101	Ballistic Thermopile (1cm aperture).....	525.00
	Permits an oscilloscope observation of laser output pulses in addition to measuring energy output	
102	Energy Meter for use with 100/101.....	585.00
107	Ballistic Thermopile (2cm aperture).....	550.00
108	Ballistic Thermopile (2cm aperture).....	690.00
113	Energy Meter for use with 107/108.....	585.00
105B	Photodetector.....	
	With S-4 Surface.....	1500.00
	With S-1 or S-20 Surface.....	1850.00
	With S-1 UV Surface.....	1850.00

LASER SYSTEMS

103A	Minilaser - 300 Millijoules.....	
	Consists of: 103A-1 Laser Power Supply.....	1000.00
	103A-2 Laser Head.....	1000.00
104A	Laser System and Accessories.....	
	104A-1 Laser Power Supply.....	2950.00
	104A-2 Laser Head.....	
	Supplied with Czochralski ruby.....	2090.00
	Supplied with Nd+++ rod.....	1950.00
	104A-3 Rotating Prism Q-switch.....	2200.00
	104A-4 Second Harmonic Generator.....	950.00
	Specify wavelength, 6943Å or 10600Å, at which SHG will be used	
	104A-5 Bleachable Q-switch.....	750.00
	104A-6 Bleachable Single Pulse Accessory.....	500.00
	This accessory is included as part of the Model 104A-100 Megawatt Laser System. If this Model 104A-6 Single Pulse Accessory is purchased as an individual component or for addition to an existing Model 104A Laser System, the buyer should be aware that damage to the laser crystal may occur due to the higher achievable power densities. Check with TRG Sales (516/531-6343) regarding questions on how to utilize this accessory in the buyer's system. Specify wavelength at which accessory is to be used (6943Å or 10600Å).	
	104A-7 Base Plate to aid precise aiming of laser head.....	250.00
	Standard Czochralski ruby rod with lucalox holders.....	690.00
	Standard Czochralski ruby rod, without holders, ground for 104A-2 Laser Head.....	615.00
	Nd+++ doped glass laser rod including UV filter and holder.....	375.00
	Nd+++ doped glass rod, without filter and holder, ground for 104A-2 Laser Head.....	350.00

Dielectric coated output reflector (Specify 6943A or 10600A).....	100.00
Cavity reflector for 104A-2 Laser Head.....	90.00
Resonant reflector for 104A-2 Laser Head.....	200.00
Replacement flash lamps for 104A-2 Laser Head....	64.50

Model 104A Laser System capable of 100 megawatt output..... 8600.00

Model 104A Laser System capable of 100 megawatt output with beam  
divergence of less than 3 milliradians..... 9600.00

Model 200B Laser System capable of 100 megawatt output at 15 *pps*... 19950.00

#### Model 300 Series

Model 301 Laser System capable of 250 megawatt output..... 19950.00

Model 302 Laser System capable of 600 megawatt output..... 24950.00

Model 303 Laser System capable of 1000 megawatt output..... 29950.00

#### LASER ACCESSORIES

109A Daly-Sims Accessory..... 1500.00

104A-8 Base Plate - to facilitate mounting and alignment  
of the 104A Laser System with the 109 Daly-Sims  
Accessory independent of an optical bench..... 495.00

#### LASER SAFETY EYESHIELDS

112 Laser Safety Eyeshields..... 50.00

#### BIOLOGICAL LASER SYSTEM

513 Biolaser System.....  
Designed specifically for Leitz microscopes but  
adapters are available for other microscopes.  
Contact TRG Sales regarding customers' require-  
ments.

Consists of: 103A Minilaser..... 2000.00  
153A Coupling with 513-4  
Safety Interlock..... 1200.00

#### Accessories:

153A-5 Camera Adapter including Optics and  
Dichroic Filter (Specify camera to be used) 250.00  
513-5 Substage Energy Monitor..... 325.00  
102 Energy Meter..... 585.00

- NOTE: (1) All delivery quotations are subject to prior sale.  
(2) Prices and specifications are subject to change without notice.  
(3) This price list is in effect until May 1967.





ROUTE 110 • MELVILLE, NEW YORK 11746 • 516/531-0600

Dear Sir:

The literature you requested regarding our Model 513 Biolaser is enclosed. The 513 is an improved design of our earlier 503 Biolaser which has been used extensively in the biological field.

You will note from the literature that the system is capable of producing spot sizes as small as  $1\mu$  and has the unique feature that still or motion picture photography can be accomplished simultaneously with the firing of the laser pulse.

The various applications to which this system has been applied are described in the enclosed literature.

The 513 Biolaser with power supply for attachment to your microscope is priced at \$3200. Any adaptations necessary for optics, camera, etc., can be supplied at additional cost. Accessories are also available for monitoring the laser output at the stage.

Thank you for your inquiry, and we look forward to being of service to you. Please contact us at the plant if you require any additional information.

Sincerely,

*Raymond Forestieri*

Raymond Forestieri  
Sales Engineer

RF/Mc  
Enclosure